

ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF PUBLIC HEALTH



**Evaluation of Mini Nutritional Assessment tool among
Elderly population in Yeka Sub city, Addis Ababa, Ethiopia**

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APPROVAL BY THE BOARD OF EXAMINERS

This thesis by Mesfin Agachew is accepted in its present form by the board of examiners as fulfilling thesis requirement for the degree of master in Public Health.

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ACRONYMS AND ABBREVIATIONS

AUC	Area Under the Curve
BMI	Body Mass Index
CC	Calf Circumference
CGA	Comprehensive Geriatric Assessment
EFMoH	Ethiopian Federal Ministry of Health
IADL	Instrumental Activities of Daily Life
MNA	Mini Nutritional Assessment
MNA-SF	Mini Nutritional Assessment Short Form
MS-MNA	Modified Short Mini Nutritional Assessment
MUAC	Mid Upper Arm Circumference
ROC	Receiver operating characteristics
SNAQ	Simplified Nutritional Assessment Questionnaire
SPH	School of Public Health
SPSS	Statistical Package for Social Sciences
WHO	World Health Organization

ABSTRACT

Background: Malnutrition is the most important determinant factor for elders on their general health and quality of life. Eventhough the life expectancy of Ethiopian elders is increasing; there was no valid tool to assess the nutritional status of elders. Body Mass Index (BMI) may be unreliable to assess the nutritional status of elders if used as single measurement. Mini nutritional assessment (MNA) tool is the most widely used and noninvasive tool to assess the nutritional status of elders. MNA tool was not validated and practiced for intervention in Ethiopian elderly population.

Objective: To evaluate the reliability and validity of mini nutritional assessment tool among elders in Yeka sub city, Addis Ababa, Ethiopia.

Method: Community based cross sectional study was conducted among 506 elders. Two stage cluster sampling method and systematic random sampling technique was employed to address study subjects. The reliability and validity of the MNA tool and MNA-SF were evaluated against BMI. A modified short Mini Nutritional Assessment (MS-MNA) tool was derived by a principal component analysis. The items to create MS-MNA were derived from the full MNA tool and appetite assessment tool. Accuracy, sensitivity, specificity and cut off point were evaluated to determine validity of full MNA and MS-MNA. The reliability also assessed using Cronbaches α coefficient. Criterion-related validity of the MNA tool was evaluated computing the correlation between total MNA score and single anthropometric measurements. Youden index used to determine best cut of points for MNA and MS-MNA tool.

Result: The mean MNA score was 19.9 ± 4.5 . Cronbaches α value of full MNA tool was found 0.7. The overall accuracy of full MNA was 91% (95 % CI, 87.5%--94.9%, $p < 0.001$). The sensitivity and specificity of full MNA tool using established cut of point was 87.9% and 89.6% respectively. Using Youden index the best cut of point to detect malnourished and risk of malnutrition was found 16 with sensitivity 90.4% and specificity 86.8%. Cronbaches α value of MS-MNA tool was found 0.71. The overall accuracy of MS-MNA was found 87 % (95%CI, 0.837-0.910, $p < 0.001$). Using Youden index the best cut of point was 14.5 with sensitivity and specificity of 80% and 80.2% respectively.

Conclusion: Full MNA tool was valid and reliable to identify elders as malnourished, at risk of malnutrition and well-nourished with modulation of cut of points. The MS-MNA tool was also reliable and valid nutritional assessment tool. However, the short MNA tool was not valid and reliable in this study. Further research is recommended to validate the MS-MNA tool against biochemical markers.

1. INTRODUCTION

1.1 Background

Malnutrition defined as “the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions”. It may be caused by the lack of one or more nutrients (under nutrition), or an excess of nutrients (over nutrition[1]. In the ageing and sick population, malnutrition is an important problem that has been seen in hospitals, residential care and in the community[2]. Malnutrition is not an inevitable side effect of ageing, but many changes associated with the process of ageing can promote malnutrition. For example, ageing is frequently associated with decreases in taste acuity and smell, deteriorating dental health, and decreases in physical activity, which may all affect nutrient intake. Any change in nutrient intake can lead to malnutrition with its potentially serious consequences[3].

Elderly people over the age 60 years are growing rapidly in developing countries. By 2030, the elderly population in the developing world is projected to grow 140 percent[4]. The elderly population in developing countries is growing more rapidly than in more developed nations and it is projected that in 2020, 70% of those aged above 60 years will live in developing countries[5]. Fifteen percent of the world population and 4.7% of Ethiopian population is categorized as elderly population aged ≥ 60 years[6, 7].

The Mini Nutritional Assessment tool (MNA) tool, which was published in 1994, is a short, non-invasive, reliable and extensively evaluated nutritional assessment tool for free-living and clinically relevant elderly populations. It was developed by Nestlé and leading international geriatricians and well validated in international studies in a variety of settings[8]. Similarly, MNA tool is suggested by the European Society for Clinical Nutrition and Metabolism for routine geriatric nutritional assessments. The full MNA is the original version of the MNA and takes 10-15 minutes to complete[9]. A number of nutritional assessment instruments including the Mini Nutritional Assessment (MNA) have been developed to assess nutritional status of elderly[10].

1.2 Statement of the Problem

Old age people are more susceptible for malnutrition and infection. The cost of health expenditure associated with treating the infection and/or malnutrition is also high. In Ethiopia the elderly population is growing rapidly which could increase burden of malnutrition and other non-communicable diseases in the future[11]. Older people are highly neglected from different health and social interventions carried out by different stake holders. In the nutrition sector, interventions and priorities given for children and women of childbearing age, and where as the nutritional status of older people is almost never assessed, despite their vulnerability. Nutrient needs of older people are different due to natural aging process, dental problems and psychosocial issues. This makes them different and demands critical nutritional evaluation and follow up[12].

Aging may come with an accumulation of diseases and impairments, including cognitive and physical decline, depressive symptoms and emotional changes, all of which may directly influence the balance between nutritional needs and intake. Dietary behavior of older individuals may change because of health or social reasons, decrease in taste and smell, or a reduced ability to purchase and prepare food. This combination of symptoms or conditions put older individuals at a higher risk of malnutrition. Malnutrition is a prognostic factor associated with morbidity, mortality and costs of care. It is therefore important to detect those older individuals who are at risk for malnutrition[13].

If malnutrition is not intervened in its early stage among elderly population it can result in various negative health outcomes such as morbidity, poor quality of life and impaired functional autonomy. There are no comprehensive data of the prevalence of malnutrition in community-dwelling elderly individuals in Ethiopia. The Mini Nutritional Assessment (MNA), a nutritional assessment tool allows to identify elders malnourished and at risk of malnutrition[14].

Assessment of the nutritional status among elderly includes both biochemical and anthropometric measurements. However; using these two measurements together to assess nutritional status of a large number of elderly is not feasible. Therefore, for a long time single Anthropometric measurements were used to assess the nutritional status of elderly even if they failed to provide adequate estimates of nutritional status of elderly people[15]. Body Mass Index

(BMI) may be unreliable in the presence of confounding factors such as edema or ascites, and may not identify significant unintentional weight loss if used as a single assessment[16]. The MNA can be easily administered by peripheral or primary level health staff, without the need for biochemical testing or specific training in nutrition. Therefore, it is very important to do nutritional assessment in the elderly, making use of valid tools. MNA tool has not been evaluated in Addis Ababa elderly population, despite the fact that Addis Ababa is the most urbanized city in the nation. In light of this, this particular study was conducted to evaluate the reliability and validity of MNA tool among elders in Yeka sub city, Addis Ababa, Ethiopia.

1.3 Significance of the Study

The increasing number of elderly people with less effort to combat their health and nutritional needs seek great attention in Ethiopia. Currently increasing Ethiopian life expectancy is an indicative to give attention for elderly. However, there are no studies which assess the determinants of malnutrition in elderly people in Ethiopia. In addition, there was no valid tool to assess the nutritional status of elders in Ethiopia. There is the fact that men marry younger women and there are more widows in the world than widowers. Women in our countries rely on men for economic resources, making them at risk for dependency, isolation, neglect, and poverty[17].

Evaluation of MNA tool is important for elders to assess their nutritional status and to have timely intervention. Assessment of nutritional status of elders is primarily helpful for elders to have adequate understanding on their nutritional status. This gives them to have a habit of good nutrition and profoundly increased life expectancy. This study will help health care providers to assess the nutritional status of elders using the appropriate tool and provide appropriate care to improve their nutritional status. Evaluation of the tool and clear understanding on the nutritional status of elderly individuals extremely useful for evidence based intervention. The study will also have contribution for governments, program managers and policy makers to give priority and give attention on nutritional status of elderly individuals. Therefore, the present study was conducted with the objective to evaluate whether MNA can identify malnutrition and risk for malnutrition among elderly population living in urban community of Yeka sub city, Addis Ababa, Ethiopia.

2. LITERATURE REVIEW

2.1 Burden of under nutrition among elderly people

Malnutrition is a common clinical and public health problem, which has adverse effects on every system of the body and on physical and psychological function. Malnutrition is both a cause and consequence of disease, delaying recovery from illness and increasing the risk of complications.

This is at enormous cost to individuals, health care systems and society[18]. Malnutrition is the condition that develops when the body does not get the right amount of vitamins, minerals and other nutrients (e.g. energy, protein) it needs to maintain health, promote cell and tissue growth and normal organ function. Malnutrition may result from consuming too little food, a shortage of key nutrients, or altered absorption or metabolism. Older adults are at particular risk of malnutrition[12].

Estimates of the prevalence of malnutrition vary by setting, subgroup and method of assessment. Prevalence rates may be affected by confounding factors such as disease status or setting. Definitions vary across studies, and sample sizes are often too small to allow for meaningful interpretation of data[19]. Across sectional study done in 2015 for Portugal elders on validity of MNA revealed that the tool was valid for elders to assess the nutritional status with specificity and sensitivity 74.0-85.1% and 64.2-94.2% respectively. Another study done in Spain on reliability of MNA in institutionalized elders shows that the internal consistency is 0.83 and concluded MNA is reliable for elders[20].

Across sectional study conducted in Netherlands on prevalence and determinants of malnutrition in geriatric out patients, 17% of respondents are malnourished and 58% are at risk for malnutrition. According to this study, Depression, being independent activities of daily life (IADL) dependent, and smoking were independently associated with an increased risk of malnutrition. Alcohol use was associated with a decreased risk[13]. Similar study conducted in Brazil found that 29.7% were undernourished according BMI cut of point by WHO[21]. Another community based cross sectional study conducted in Iran revealed that 12%, 42.7%, 45.3% were malnourished, well-nourished and at risk for malnutrition respectively. On this study, females are more malnourished than males, non-educated than educated, lonely than living with family and unemployed than employed which was assessed using mini nutritional assessment method[22].

After two years of this study in Iran, another study conducted on validation of MNA for elders to assess the nutritional status and found that sensitivity and specificity of 88% and 62 % respectively. The study also revealed that reliability of the tool using Cronbach's α coefficient is 0.61 and concludes MNA was not reliable to assess the nutritional status for elders in Iran with established cut of points[23].

Mini Nutritional Assessment tool was used in Brazil to assess the nutritional status of institutionalized elderly populations and they found that 66.35 were malnourished and at risk of malnutrition. On this study, it has been observed that among men the prevalence of this condition (76.6%) was higher than in women (62.4%)[24]. A study conducted in Lebanon, the same tool was used and done on rural community revealed that 8% were malnourished and 29.1 were at risk for malnutrition. According to this study, socio-demographic status, among women the level of illiteracy and poor income was significantly higher than in men. Moreover, chronic diseases, poor self-perceived health, frailty, functional disability, depressive symptoms and cognitive impairment were particularly high and significantly more frequent in women than in men[5]. A recent community based cross sectional study on nutritional status of elderly population in south west China showed 3.2% and 19.3% were malnourished and at risk for malnutrition respectively[25]. On the studies discussed above we conclude that malnutrition prevalence in community based compared to facility based is much lower.

Even though it was necessary to assess the nutritional status for elders in Ethiopia, there is no validated tool and their nutritional status was not assessed. A cross sectional a study conducted in Ethiopia on prevalence of under nutrition among elderly population in Gondar found that 21.9% were undernourished. According to this study, being female, being older, being poor, having poor dietary diversity and being none educated are independently and negatively associated with elderly nutritional status. But this study uses BMI to assess the nutritional status which was highly affected with confounders especially in elders[17].

Another study done in Ethiopia on evaluation of MNA tool among community dwelling elderly population in Hawassa found that 28.3% were malnourished and 62.4% were at risk for malnutrition. The study also showed that the sensitivity and specificity was 80.1 and 72.5 respectively with the established cutoff points. The study also revealed that a significant positive correlation was found between total MNA score and the eighteen items of MNA and reliability

of 0.65 [15]. There was no another study conducted on evaluation of MNA tool and the current study may not represent elders population in Addis Ababa and they strongly recommend further study on validation of MNA tool . Therefore, the present study aimed to assess the reliability of MNA tool among elders in Addis Ababa. Both studies conducted in Ethiopia showed that prevalence of under nutrition was high and indicative to conduct further study.

2.2 Nutritional assessment for elders and Mini Nutritional Assessment Tool

The development of the MNA began during the 1989 International Association of Geriatrics and Gerontology (IAGG) meeting in Acapulco with a discussion between Bruno Vela's (Department of Geriatric Medicine, Toulouse University Hospital, France) and Yves Guigoz (Researcher at the Nestle Research Centre, Switzerland). This meeting highlighted that even if there was proven evidence of the high prevalence of malnutrition in institutionalized, frail and hospitalized older people, nutritional assessment was not currently performed in clinical practice due to the complexity of nutritional evaluation. The aim of the discussion was to design an assessment tool for nutritional status in older people, analogous to the Mini-Mental State Examination (MMSE) for the assessment of cognitive function, reliable, cheap and quick to perform[26].The MNA was initially validated in a cohort of more than 150 healthy, frail and acutely ill elderly patients in Toulouse, France, between 1990 and 1991. Subsequently, the MNA was validated in the New-Mexico Aging Process Study (NMAPS), a longitudinal survey on nutrition and aging and in 2001 by the Nestle Research Centre in Lausanne(Switzerland)[27].

MNA shows good sensitivity and specificity compared to a variety of nutritional assessment parameters including biochemical values, anthropometric values and dietary intakes[20]. Mini Nutrition Assessment (MNA) tool contains geriatric-related assessment questions specific to nutritional and health conditions, autonomy, quality of life, cognition, mobility and personal health[9].The full MNA is an excellent tool for the research setting. It may provide additional information about the causes of malnutrition in persons identified as malnourished or at risk for malnutrition. Full MNA is composed of 18 questions which are divided in to four main categories; dietary assessment, subjective assessment, global assessment and anthropometric data. Full MNA gives a maximum of 30 points and it classifies the elderly as: malnourished (MNA < 17 points), at risk of malnutrition (MNA: 17–23.5) and well nourished(MNA > =24 points).[28].

The short-form (MNA-SF), consisting of six items, was published in 2001. In 2009, a revised version of the MNA-SF was proposed to overcome certain drawbacks of the previous MNA-SF. The MNA-SF now features the same three categories as the full MNA. All items of MNA-SF were derived from full MNA. The MNA-SF may now be completed using calf circumference instead of BMI in cases of missing weight and height data[29]. MNA-SF has maximum of 14 points and it classifies the elderly peoples as malnourished(MNA-SF<8), at risk of malnutrition (MNA-SF 8-11) and well nourished (MNA-SF>= 12)[28].

Nutritional assessment in older people to detect malnutrition or risk of malnutrition is essential to avoid adverse nutrition-related outcomes. Poor nutritional status appears to be a major contributing factor for poor prognosis in malnourished individuals. After 20 years of clinical practice and research, the Mini Nutritional Assessment (MNA) seems to be the tool most widely accepted by health cares and patients for the assessment of nutritional impairment in CGA. MNA classifies, with well-established thresholds, the nutritional status of older people with the added advantage of proposing and guiding interventions. Even more, the MNA is correlated to nutritional interventions when these are successful, with improved scores showing response to the intervention[30].

2.3 Conceptual frameworks

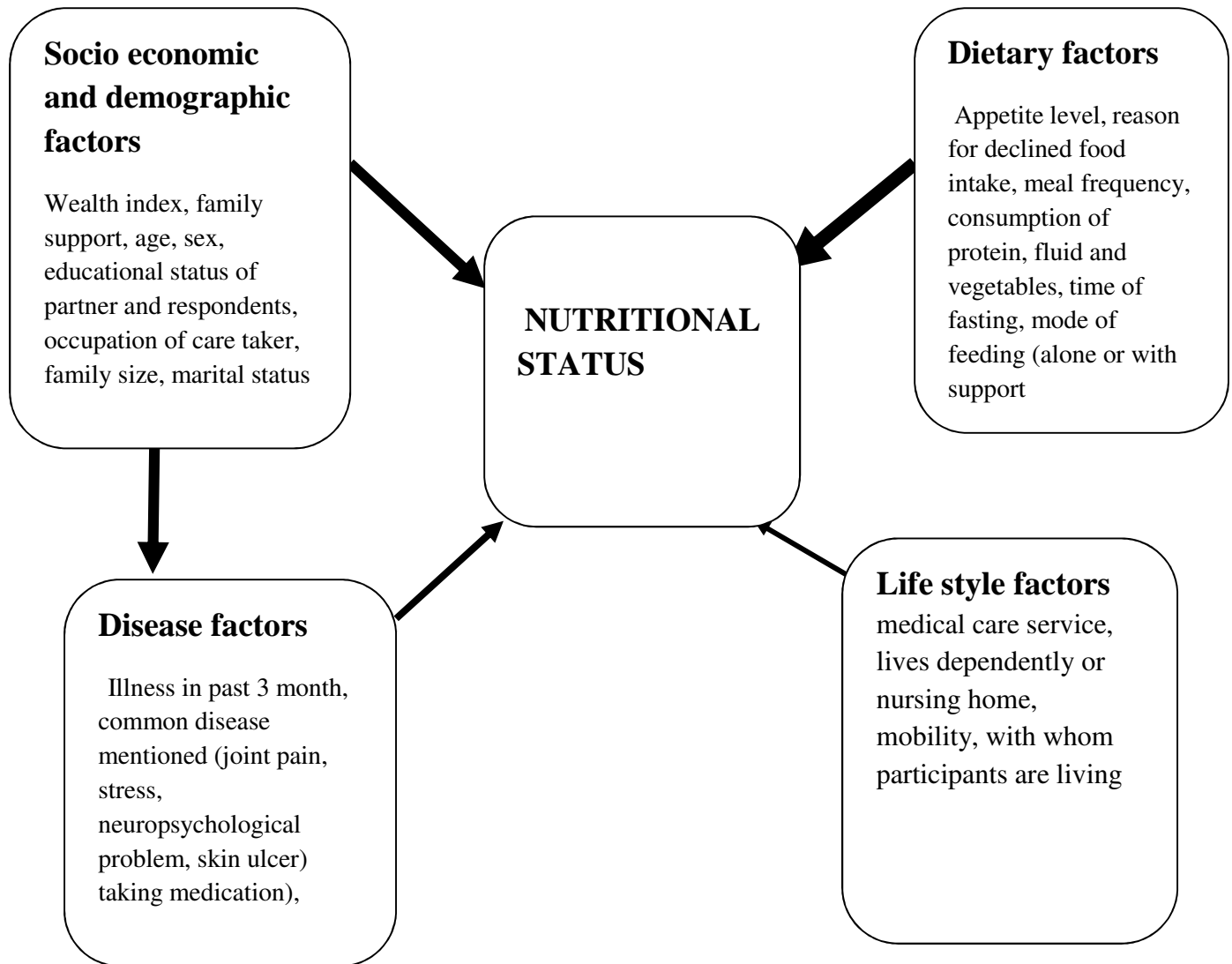


Figure 1 conceptual frame work

(Adopted from malnutrition in an aging population.2010)

3. OBJECTIVE OF THE STUDY

3.1 General Objective

- To evaluate the validity and reliability of Mini Nutritional Assessment tool among elders in Yeka Sub city, Addis Ababa ,Ethiopia

3.2 Specific Objectives

- To determine the validity of Mini Nutritional Assessment tool among elders in Yeka sub city, Addis Ababa, Ethiopia
- To determine the reliability of Mini Nutritional Assessment tool among elders in Yeka Sub city , Addis Ababa, Ethiopia
- To derive Modified Short Mini Nutritional Assessment tool which is valid and reliable for Ethiopian setup

4. METHODOLOGY

4.1 Study Area and Period

This study was conducted in Addis Ababa community dwellers from March 5, 2017 to April 7, 2017. Addis Ababa is the largest city of Ethiopia. It is located on a well-watered plateau surrounded by hills and mountains in a geographic center of the country. Since the late 19th century, Addis Ababa has been the capital city of Ethiopian state. There are 10 administrative sub cities in Addis Ababa .Yeka sub city is the second largest sub city next to Bole sub city which is located in the North Eastern part of Addis Ababa with an elevation of 2,355 meter above sea level. Structurally Yeka sub city has 13 administrative woreda and has an area of 85.46 km² with population size of 433,475. In the sub city there was also Mekedonia elders association getting support from different non-governmental organization and from the community. According to Ethiopian central statistical agency in 2014, the Ethiopian elder population is estimated to be 4.7% of the total population[7].

4.2. Study Design

Community based quantitative cross sectional study was conducted among community dwelling elderly.

4.3 Population

Source Population

The source population was all elderly people age ≥ 60 years living in Yeka sub city.

Study Population

The study population was all elderly people in randomly selected woreda in Yeka sub city.

4.4 Eligibility Criteria

Inclusion Criteria

All elderly people age greater than or equal to 60 years living in selected cluster that live for 6 month or greater included in the study.

Exclusion Criteria

- Edematous old ages were not included in the study.
- Severely ill elderly people were not included in this study

4.5 Sample size and sampling procedure

4.5.1 Sample Size Determination

The final sample size was determined by using a single population proportion formula using the prevalence of malnutrition 28.3 % which was done in Hawassa and published in 2016[15] with 95 % confidence level and a maximum discrepancy of 5%. The sample size calculated using the formula;

$$n = \frac{(Z_{\alpha/2})^2 p (1-p)}{d^2}$$

Where;

n= sample size

Z= Standard proportion population at 95% confidence interval (1.96)

P= Estimated proportion of malnutrition

d= Margin of error

$$n = \frac{(1.96)^2 \times 0.28(1-0.28)}{(0.05)^2} = \frac{3.84 \times 0.28 \times 0.72}{0.0025} = 307$$

By considering design effect 1.5 $n = 307 \times 1.5 = 460$ by considering non response rate 10% = 46

The final sample size (n) was $n = 460 + 46 = 506$

4.5.2 Sampling Procedure

Two stage cluster sampling technique was used to address study subjects. Yeka sub city selected purposively from other sub cities because of larger population. Simple random sampling technique was used to select 4 woredas (greater than 30 %) from the total of 13 woredas in the sub city. Three ketenas (clusters) from each woreda were selected using simple random sampling technique. The total sample size was proportionally allocated for each ketena depending on the number of the households in each ketenas .The study subjects from each ketenas were selected by calculating interval using systematic sampling techniques i.e. dividing the total households to total sample size allocated for specific ketenas. Subsequently, study subjects (household) including rented houses those full fill house hold definition selected every 8th house of elderly

population. If the selected house is closed, not available during the data collection time, the next house was considered. When there were more than one elder in one house, one elder was selected by lottery method.

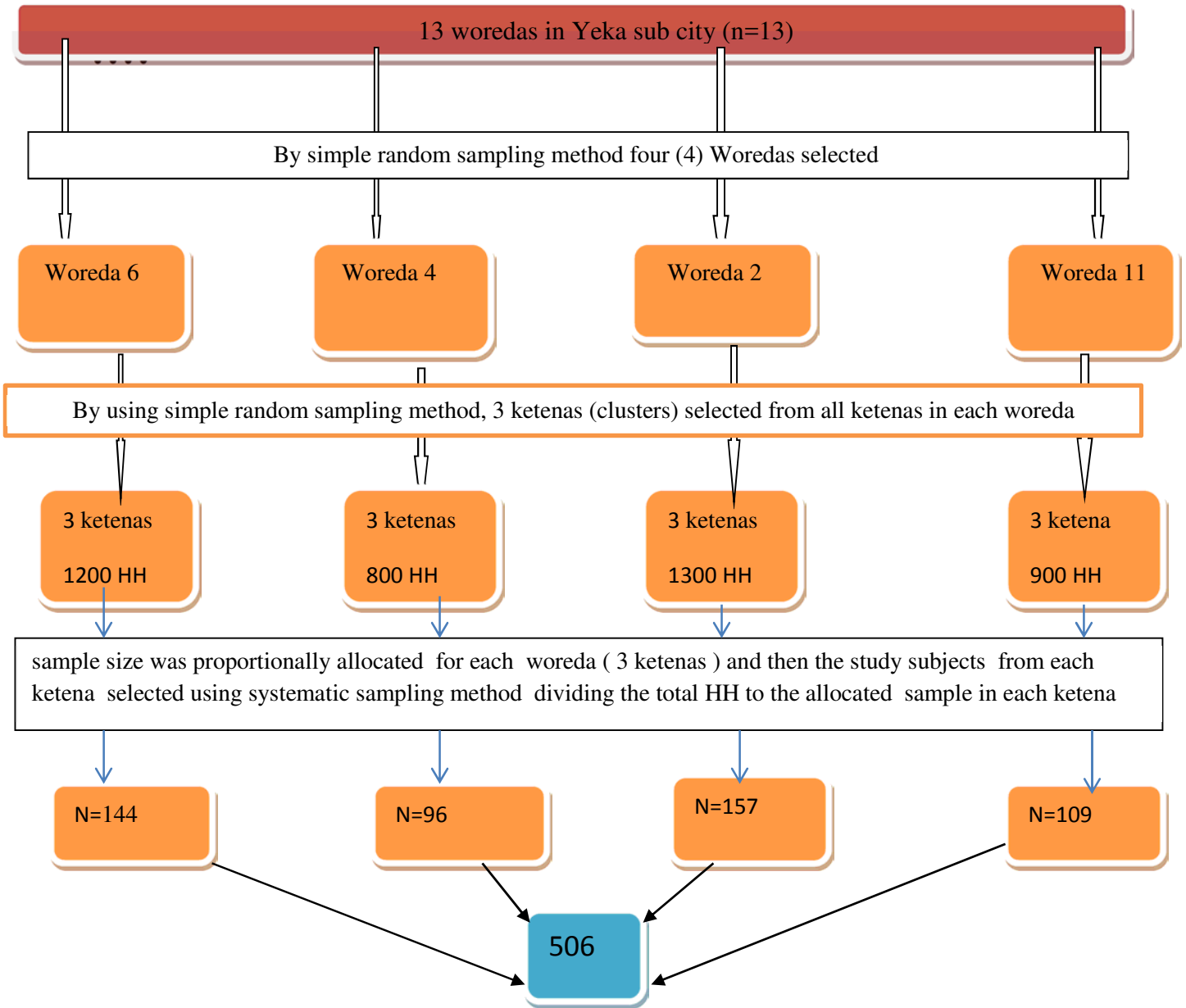


Figure 2. Sampling procedure to address study subjects in Yeka Sub city, Addis Ababa, Ethiopia, 2017.

4.6 Evaluation of Reliability and Validation of the MNA tool

The MNA tool total score was taken and validated against BMI. BMI was used for validation as a standard instead of dietary intake or clinical data because there exists recall bias in case of dietary data and limitation of getting high quality and full clinical data[15]. Different studies in Hawassa, Iran, Brazil and Nepal conducted to evaluate the tool using BMI as a standard[14, 15, 23, 31]. Reliability of the tool was evaluated using coefficients of Cronbach's α . Therefore, the reliability and validity of the tool were highly dependent on correlation between the total MNA score and BMI. The accuracy of the tool was checked using Receiver Operating Characteristics (ROC) curve. Sensitivity, specificity and Pearson correlation were also done to assess validity of the tool.

All interviews from MNA tool regarding the nutritional and health conditions, functional independence, quality of life, mobility, cognition and subjective health were assessed by trained clinical nurses as per the standard stated in the original MNA tool[28]. As a component of the full MNA, all anthropometric measurements (weight, height, mid upper arm circumference and calf circumference) were measured on the non-dominant arm and leg. All the 18 items of MNA that were administered to elderly are (Changes in dietary intake in past 3 months, weight loss in past 3 months, mobility, psychological stress or acute disease in past 3 months, dementia, BMI, lives independently, more than 3 prescription drugs per day, pressure sores, number of full meals per day, protein intake, fruits or vegetables intake, fluid intake, mode of feeding, self-perceived nutritional status, self-perceived health status, Mid-arm circumference, calf circumference).

The Simplified Nutritional Appetite Questionnaire (SNAQ) is a brief, four-item survey that can be self-administered or given by nonmedical personnel. The simplified Nutritional Assessment Questionnaire was evaluated for its reliability. Simplified Nutritional Appetite Questionnaire (SNAQ) contains 4 items with a maximum score of 20 points and a score of <14 points indicates significant risk of at least 5% weight loss within six months[32]. This tool predicts weight loss in both community-dwelling and institutionalized individuals. After evaluating the full MNA tool the Modified Short Mini Nutritional Assessment (MS-MNA) tool was derived using principal component analysis with Eigen value of greater than 0.5. For MS-MNA, 8 items selected from SNAQ and full MNA and reliability and validity was evaluated.

Operational Definition

- **Under nutrition** - for this study determined by MNA tool cut of point after Mini Nutritional Assessment tool validated and categorized as under nutrition when MNA score <17 points
- **At risk of malnutrition**- when total Mini Nutritional Assessment score is 17 to 23.5
- **Well-nourished**- when Mini Nutritional Assessment score greater than 24
- **Full meal**- in this particular study full meal taken when elders eat one enjera with wot or similar to lunch and dinner.

4.7 Data Collection Procedure and Instrument

Data collection carried out using pre tested and structured questionnaires. Full MNA tool was administered for elders and it was adapted from nestle nutrition institute[12]. The questionnaires were prepared in English and translated in to Amharic and translated back into English by third person to check the consistency of the language. The data was collected with 3 clinical nurses, 3 urban health extensions and 2 supervisors after 2 days training. Socio demographic (age range, family size and marital status) and economic characteristics (educational status of participants and partner, occupation of care taker, with whom participants are living and income status) were assessed. The socio economic status was determined by using wealth index constructed based on household assets and household condition. The wealth index was constructed using principal component analysis (poorest, poorer, medium, richer and richest). Variables included in the construction of the wealth index were ownership of selected household assets, size of agricultural land, quantity of livestock and materials used for house construction[7].

4.7.1 Anthropometric Measurement

Height measurement: Height was measured with the study participant standing with his or her back against the measuring board, heels, buttocks, shoulders and head touching a flat upright Sliding head piece. The participants' legs were place together making the knees and ankles touching each other. Height measurement was taken at maximum inspiration and the height was recorded to the nearest 0.1 cm.

Weight measurement: the study participants were weight using Seca scales. The scales were validated with standard weights before actual weighing of the study participant. The scales were placed on a hard flat surface and participants were weighed wearing only lightweight clothing (excluding jackets, shoes, and belts). Each study participant was measured twice and the average of the two measurements was recorded. In cases where the difference between the two measurements exceeded the tolerance limit the degree to which the two measurements are close), the participants repositioned and weighted a third time.

Mid Upper Arm Circumference (MUAC):-was measured to the nearest 0.1 cm at the mid-point between the tip of the acromion and the olecranon process on the back of the arm while the subject holding the forearm in horizontal position. The measurement was performed on the subject's arm hanging freely along the trunk using inextensible MUAC tape.

Calf circumference: - the widest calf circumference was measured between the ankle and knee to the nearest 0.1 cm using non stretchable tape in a sitting position with the leg bent 90° at the knee and manipulated to maintain close contact with the skin without compression of underlying tissues.

Body Mass Index (BMI):- Calculated as body weight in kilograms divided by the square of height in meter.

4.8 Data Quality Management

The data collectors and supervisor took two days of data collection training on how to conduct interview and anthropometric measurements. The weight scale was validated by using standardized weight before actual weighing of each study participant. The quality of data was assured through careful design, translation and pretesting of questionnaire, and proper handling of data. The data was monitored frequently during data collection and collected questionnaires were examined for completeness and consistency during interview and at the end of each day. For the appropriateness of the designed questionnaire, pretesting of the questionnaire and translating to appropriate language done before the actual data collection procedure. To ensure the accuracy and quality of data entry, epidata checks and cleaning were used.

4.9 Data Entry and Statistical Analysis

The data was entered using Epi-data version 3.1, exported to SPSS version 22.0 to be cleaned and analyzed. Modified short MNA (MS-MNA) tool was developed using principal component analysis and more correlated items selected from full MNA and SNAQ components. Eight items selected as a component of MS-MNA tool with Eigen value of greater than 0.5 to assess the nutritional status of elders. MS-MNA has 8 items and a maximum score of 25 points.

Internal consistency (reliability) of full MNA and MS-MNA tool were assessed by split half reliability method using Cronbach's coefficient. Correlation between the total MNA score obtained and eighteen items of MNA were calculated to estimate the reliability of the tool. Value of 0.60, 0.70 & 0.80 were considered acceptable, adequate and good respectively[15]. BMI has been found to be a useful tool in clinical and public health practice for assessing the nutritional status of adults as well as the elderly[31]. Therefore, Sensitivity and specificity of the MNA tool were calculated using cross tabulation considering nutritional status of elders with MNA score against BMI. It was done by taking the number of malnourished and well-nourished elders using BMI with in malnourished and well-nourished elders using MNA tool.

Criterion related validity of the tool was checked after identifying a significant positive Pearson correlation between total MNA score obtained and the single anthropometric measurement, as criteria of BMI, weight, MUAC, and calf circumference. Pearson correlation was calculated to correlate total MNA score obtained and self-perceived nutritional status of participants to assess concurrent validity of MNA tool. The overall accuracy of MNA tool was assessed using the area under the curve (AUC). Diagnostic accuracy of MNA, denoted by the area under the ROC curve and ranging from 0 to 1, was defined as follows, excellent, ≥ 0.9 , Good, 0.8-0.9, worthless, 0.7-0.8, and 0.6-0.7 not good.[33]. Youden index criteria used to define sensitivity and specificity cut of points.

4.10 Ethical Clearance

Ethical clearance was obtained from Ethical Review Committee (ERC) of Addis Ababa University, College of Health Science, School of Public Health and Research Ethics Committee of Addis Ababa Health Bureau. Official letters of co-operation from ERC obtained and given to study selected woreda. Prior to the interview written consent was obtained from study participant who were above 60 years. Information given for participants about the voluntary basis of participation and that they can stop the interview at any time if they are not comfortable. In order to ensure participants' confidentiality, data collectors and supervisors were assigned based on their work place in their community and no names or personal identifiers were included in the written questionnaires. If elders found with malnutrition and other disorder during data collection time, they were advised to have proper care and linkage to the nearest health institutions done.

4.11 Dissemination and Plan

The finding of this research were disseminated in print form and submitted to Addis Ababa University, College of health Science, School of Public Health, Research and publication office and effort will be made to publish the results in relevant peer reviewed journals.

5. RESULT

5.1 Socio demographic characteristics of participant

The overall response rate for each MNA question was 100%. The mean age (\pm SD) of the participants was 68.6 ± 7.2 years of age. Five hundred six elderly, 259(51.2%) females and 247(48.8%) males participated in the study. Majority of the participants, 374 (73.9%) were Orthodox Christians. Forty percent, 201(39.7 %) do not read and write. Sixty five percent, 327 (64.6%) were widowed and 127(28.1%) were married. (Table 1).

Table 1: Socio demographic characteristics of elders in Yeka Sub city, Addis Ababa, Ethiopia, 2017 (n=506)

Variables	Frequency	Percent (%)
Age group in years		
60-69 years	311	61.5
70-79 years	149	29.5
80 years and above	46	9.1
Respondents sex		
Male	247	48.8
Female	259	51.2
Religion		
Orthodox	374	73.9
Muslim	81	16
Protestant	42	8.3
Other*	9	1.8
Ethnicity		
Oromo	137	27.1
Amhara	282	55.7
Tigre	48	9.5
Gurage	34	6.7
Others#	5	1
Educational status		
Unable to read and write	201	39.7
Read and write only	86	17
Primary level completed(1-8)	132	26.1
Secondary and above	87	17.2
Marital status		
Married	142	28.1
Widowed	327	64.6
Single	37	7.3

*Catholic

#Sidama, Wolayta

5.2 Reliability of Full MNA Tool

BMI showed a significant positive correlation to the total MNA score ($r=0.639$, $p<0.001$). In contrast, pressure sore and more than 3 prescription drugs showed poor correlation to the total MNA score, $r= 0.065$, $p<0.147$ and $r=0.097$, $p<0.03$ respectively. Over all, there was a significant positive correlation ($r>0.3$) between the total MNA score and the eighteen items of MNA tool which strengthens the reliability of MNA tool. Pressure sore and more than 3 prescription drugs per day have weak correlation compared to other items of MNA tool (**Table 2**).

Table 2: Correlation between total MNA score and eighteen items of MNA among elders in Yeka sub city, Addis Ababa, Ethiopia, 2017 (n=506)

Item no.	MNA variable	r	p-value
1	Change in dietary intake in the past 3 month	0.542	<0.001*
2	Weight loss in the past 3 month	0.560	<0.001*
3	Mobility	0.326	<0.001*
4	Stress or acute disease in the past 3 month	0.497	<0.001*
5	Dementia	0.306	<0.001*
6	BMI	0.639	<0.001*
7	Lives independently	0.347	<0.001*
8	More than 3 prescription drug per day	0.097	<0.030*
9	Pressure sores	0.065	<0.147
10	Number of full meal per day	0.381	<0.001*
11	Protein intake	0.359	<0.001*
12	Fruits and vegetable intake	0.279	<0.001*
13	Fluid intake	0.341	<0.001*
14	Mode of feeding	0.341	<0.001*
15	Self-perceived nutritional status	0.432	<0.001*
16	Self-perceived health status	0.432	<0.001*
17	Mid arm circumference	0.507	<0.001*
18	Calf circumference	0.541	<0.001*

MNA =Mini Nutritional Assessment, BMI=Body Mass Index, r = Pearson correlation,

* Significant at $P< 0.05$

The internal consistency of the MNA tool as measured by Cronbachs α coefficient was found 0.70. Omitting BMI from MNA items significantly lowers the Cronbachs α value and the reliability of the tool affected (Cronbachs $\alpha=0.644$).This showed BMI was an important variable in MNA tool items. Conversely, deleting pressure sore and more than 3 prescription drug per day increases the value of Cronbachs α to 0.702 and 0.703 respectively. Therefore, pressure sore and more than 3 prescription drug per day have contribution to lower the overall reliability of the MNA tool in this study (**Table 3**).

Table 3: Reliability of full MNA variables among elders in Yeka Sub city, Addis Ababa, Ethiopia, 2017(Cronbachs $\alpha =0.70$, no of items=18)

MNA variables	Cronbachs α if item deleted
Change in dietary intake in the past 3 month	0.673
Weight loss in the past 3 month	0.672
Mobility	0.693
Stress or acute disease in the past 3 month	0.686
Dementia	0.693
BMI	0.664
Lives independently	0.691
More than 3 prescription drug per day	0.703
Pressure sores	0.702
Number of full meal per day	0.689
Protein intake	0.687
Fruits and vegetable intake	0.695
Fluid intake	0.692
Mode of feeding	0.694
Self-perceived nutritional status	0.683
Self-perceived health status	0.691
Mid arm circumference	0.670
Calf circumference	0.675

5.3 Validity of Full MNA Tool

Criterion-related validity is obtained when the new instrument or tool correlates highly with another criterion (the gold standard) in the same area. In this study, MNA tool and BMI correlated to show the criterion related validity of the tool. Criterion related validity of MNA tool assessed by correlating the total MNA score to the single anthropometric measurements as criteria. A significant positive correlation observed between total MNA score and weight, CC, MUAC, and BMI, shown in **table 4**. Among this, MNA score showed higher positive correlation to weight and BMI, $r = 0.58$ ($p < 0.001$) and $r = 0.57$ ($p < 0.001$) respectively. Concurrent validity of MNA tool was calculated by correlating the total MNA score and self-perceived nutritional status of participants. There was positive correlation which resulted $r = 0.43$ ($p < 0.001$).

Table 4 : Correlation between total MNA score and single anthropometric measurements of elderly living in Yeka sub city, Addis Ababa, Ethiopia, 2017 (n=506)

Criterion	Coefficients(r)	p-value
MNA V _s		
Weight	0.582	<0.001*
Mid arm circumference	0.482	<0.001*
Calf circumference	0.565	<0.001*
BMI	0.573	<0.001*

MNA =Mini Nutritional Assessment, BMI=Body Mass Index, r = Pearson correlation,

* Significant at $P < 0.05$

The area under the curve (AUC) was calculated and found 0.91(95 % CI, 0.875-0.949, $p < 0.001$) which shows the overall accuracy of MNA tool to identify malnourished elderly people. According to established cut of points, the sensitivity and specificity of the MNA tool was 87.9 % and 89.6 % respectively. Youden index calculated as ($\text{Youden} = J = \max(\text{sensitivity} + \text{specificity} - 1)$). By using the Youden index the best cut of points to detect malnutrition in the present study was 16 with sensitivity and specificity of 90.4% and 86.8% respectively (**Figure 2**).

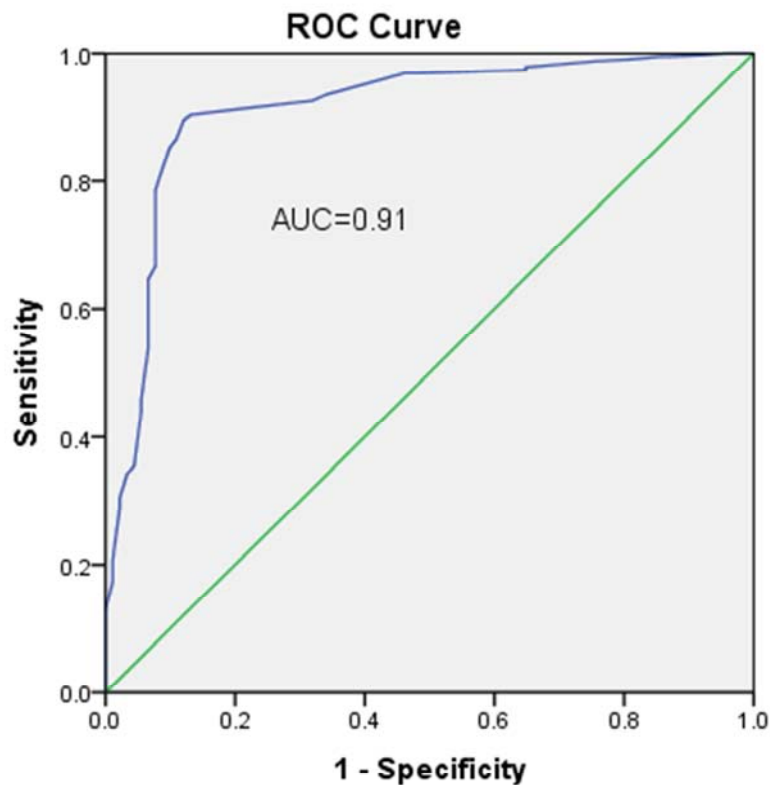


Figure 3: ROC curve of full MNA in predicting lower BMI (18.5kg/m²) as a marker of malnutrition in Yeka sub city , Addis Ababa, Ethiopia, 2017(n=506)

5.3 Reliability of Short MNA Tool

The internal consistency of short form MNA (MNA-SF) was assessed by coefficient Cronbaches α , found 0.50. After omitting each items of MNA-SF, the Cronbaches α value resulted in relatively similar value. Omitting change in dietary intake in the past 3 month in MNA-SF item lowers the Cronbaches α value to 0.424 compared to the value with six items (Table 5).

Table 5: Reliability of MNA-SF among elders in Yeka sub city, Addis Ababa, Ethiopia, (Cronbaches $\alpha=0.50$, n_o of items=6), 2017 (n=506)

MNA-SF variables	Cronbaches α if item deleted
Change in dietary intake in the past 3 month	0.424
Weight loss in the past 3 month	0.444
Mobility	0.482
Stress or acute disease in the past 3 month	0.472
Dementia	0.505
BMI	0.409

MNA-SF=Mini Nutritional Assessment Short Form, BMI=Body Mass Index

Positive correlation observed between the total MNA-SF score and the four items of MNA-SF for reliability of the tool. BMI and total score of MNA-SF revealed higher correlation($r=0.719$, $p<0.001$) compared to others. Mobility and dementia showed week correlation, $r=0.399$, $p<0.001$ and $r=0.285$, $p<0.001$ respectively compared to other items of MNA-SF (Table 6).

Table 6: Correlation between total MNA-SF score and six items of MNA-SF among elderly in Yeka sub city, Addis Ababa, Ethiopia, 2017(n=506)

Item no.	MNA variable	R	p-value
1	Change in dietary intake in the past 3 month	0.570	P<0.001*
2	Weight loss in the past 3 month	0.570	P<0.001*
3	Mobility	0.399	P<0.001*
4	Stress or acute disease in the past 3 month	0.574	P<0.001*
5	Dementia	0.285	P<0.001*
6	BMI	0.719	P<0.001*

BMI=Body Mass Index, MNA=Mini Nutritional Assessment, r= Pearson correlation

* Significant at $P < 0.05$

5.4 Validity of Short MNA Tool

Single anthropometric measurements, weight, CC, MUAC and BMI were correlated to MNA-SF as Criterion related validity of MNA-SF tool. A significant positive correlation observed between total MNA-SF and single anthropometric measurements, shown in **table 7**. Among this, MNA score showed strong positive correlation to BMI and weight, $r = 0.614$ ($p < 0.001$) and $r = 0.597$ ($p < 0.001$) respectively.

Table 7: Correlation between score of total MNA-SF and single anthropometric measurements of elders living in Yeka sub city, Addis Ababa, Ethiopia, 2017 (n=506)

Criterion	r	P-value
Weight	0.597	<0.001*
Mid arm circumference	0.472	<0.001*
Calf circumference	0.543	<0.001*
BMI	0.614	<0.001*

MNA-SF= short mini nutritional assessment tool, BMI= body mass index, r= Pearson correlation

* Significant at $P < 0.05$

The area under the curve (AUC) was calculated for MNA-SF and found 0.93(95 % CI, 0.901-0.958, $p < 0.001$) which shows the overall accuracy of MNA-SF tool to identify malnourished elderly people. According to established cut of points, the sensitivity and specificity of the MNA tool was 85.7 % and 89.7 % respectively. Youden index calculated as ($\text{Youden} = J = \max(\text{sensitivity} + \text{specificity} - 1)$).By using the Youden index the best cut of points to detect malnutrition in the present study was 7.5 with sensitivity and specificity of 85.7% and 89% respectively (**figure 3**).

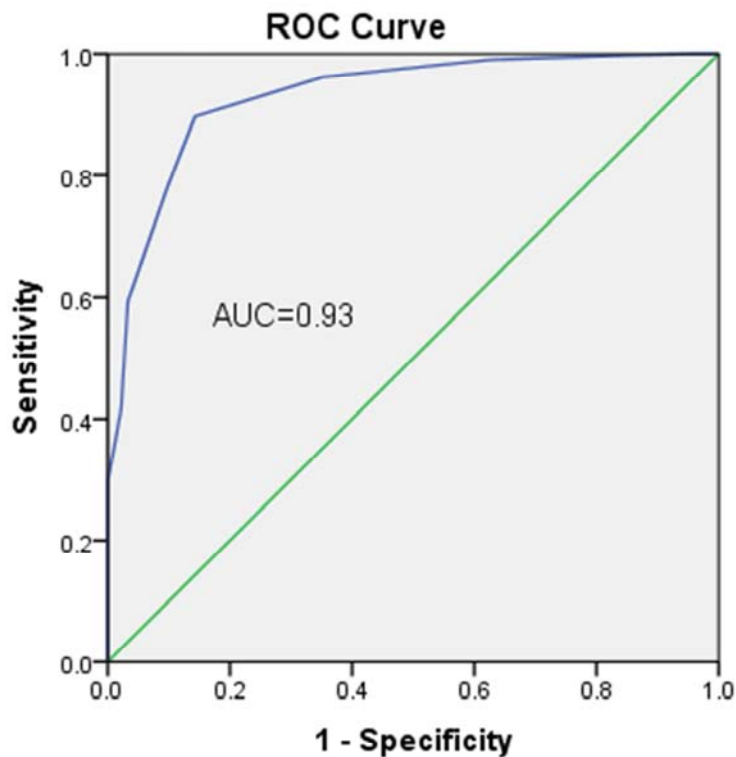


Figure 4 : ROC curve of MNA-SF in predicting lower BMI (18.5 kg/m²) as a marker of malnutrition in yeka subcity, Addis Ababa,Ethiopia,2017. (n=506)

5.5 Simplified Nutritional Appetite Questionnaire (SNAQ)

The simplified Nutritional Appetite Questionnaire (SNAQ) was correlated to its items and to the single anthropometric measurements. The internal consistency of the Simplified Nutritional Appetite Questionnaire (SNAQ) as measured by coefficient Cronbach's α was found 0.58. There was also a significant positive correlation between the total SNAQ score and the four items of SNAQ for reliability of the tool (Table 8). The correlation between the total SNAQ score and single anthropometric measurements as a criterion was very poor (Table 9).

Table 8: Correlation between total SNAQ score and four items of SNAQ among elders in Yeka sub city, Addis Ababa, Ethiopia, 2017 (n=506)

SNAQ score V_s	r	p-value
Participants appetite	0.715	P<0.001*
While participants eat	0.803	P<0.001*
Food tastes	0.617	P<0.001*
Number of full meal taken per day	0.472	P<0.001*

SNAQ= Simplified Nutritional Assessment Questionnaire r = Pearson correlation

* Significant at $P < 0.05$

Table 9: Correlation between total SNAQ score and single anthropometric measurements among elders in Yeka Sub city, Addis Ababa, Ethiopia, 2017 (n=506)

Criterion	r	p-value
SNAQ V_s		
Weight	0.210	P<0.001*
Mid arm circumference	0.032	P<0.472*
Calf circumference	0.176	P,0.001*
BMI	0.142	P<0.01*

SNAQ= Simplified Nutritional Assessment Questionnaire BMI= Body Mass Index r= Pearson correlation

* Significant at $P < 0.05$

5.6 Reliability of Modified Short MNA Tool (MS-MNA)

There was also a significant positive correlation between the total MS-MNA score and all items of MS-MNA for reliability of the tool. All items showed Strong correlation to the total score of MS-MNA tool ($r>0.3$) indicating all items of the tool should be included in the MS-MNA tool (**Table 10**). The internal consistency of the MS-MNA tool as measured by Cronbachs α coefficient was found 0.71 (**Table 11**). As shown in table 11, the overall reliability of MS-MNA tool measured by Cronbachs α value decreases below the acceptable value when each items of the tool are deleted. This showed that all the items should be included in MS-MNA tool for elderly nutritional assessment. MS-MNA tool reliability is relatively affected in small by food taste, while appetite test affects the reliability very largely if it is avoided from the tool item.

Table 10: Correlation between total MS-MNA score and the eight items of MS-MNA among elders in yeka subcity, Addis Ababa, Ethiopia, 2017 (n=506)

Item no	MS-MNA variable	r	p-value
1	Change in dietary intake in the past 3 month	0.629	P<0.001*
2	Weight loss in the past 3 month	0.548	P<0.001*
3	BMI	0.621	P<0.001*
4	Mid arm circumference	0.506	P<0.001*
5	Calf circumference	0.527	P<0.001*
6	Appetite level	0.669	P<0.001*
7	Feel full after eating	0.650	P<0.001*
8	Food taste	0.541	P<0.001*

MS-MNA= Modified short mini nutritional assessment, r=Pearson correlation, BMI=body mass index

* Significant at $P < 0.05$

Table 11: Reliability of MS-MNA tool among elders in Yeka subcity, Addis Ababa, Ethiopia, (Cronbaches α =0.711), 2017 (n=506)

Item no	MS-MNA variables	Cronbaches α if item deleted
1	Change in dietary intake in the past 3 month	0.668
2	Weight loss in the past 3 month	0.685
3	BMI	0.682
4	Mid arm circumference	0.692
5	Calf circumference	0.690
6	Appetite level	0.659
7	Feel full after eating	0.688
8	Food taste	0.694

MS-MNA= Modified Short Mini Nutritional Assessment, BMI =Body Mass Index

5.7 Validity of MS-MNA Tool

Criterion related validity of MS-MNA tool assessed by correlating the total MS-MNA score to the single anthropometric measurements as criterion. A significant positive correlation observed between total MS-MNA score and weight, CC, MUAC, and BMI, shown in **Table 12**.

Table 12: Correlation between MS-MNA tool and single anthropometric measurements among elders in Yeka Subcity, Addis Ababa, Ethiopia, 2017 (n=506)

Criterion	r	p-value
MS-MNA V_s		
Weight	0.547	P<0.001*
Mid arm circumference	0.405	P<0.001*
Calf circumference	0.514	P<0.001*
BMI	0.524	P<0.001*

MS-MNA=Modified Short Mini Nutritional Assessment, BMI=Body Mass Index, r=Pearson correlation

* Significant at $P < 0.05$

The area under the curve (AUC) for MS-MNA was calculated and found 87 % (95 % CI, 0.837-0.910, $p < 0.001$) which shows the overall accuracy of MS-MNA tool to identify malnourished elderly people. By using the Youden index the best cut of points to detect malnutrition in the present study was 14.5 with sensitivity and specificity of 80% and 80.2% respectively (**Figure 4**).

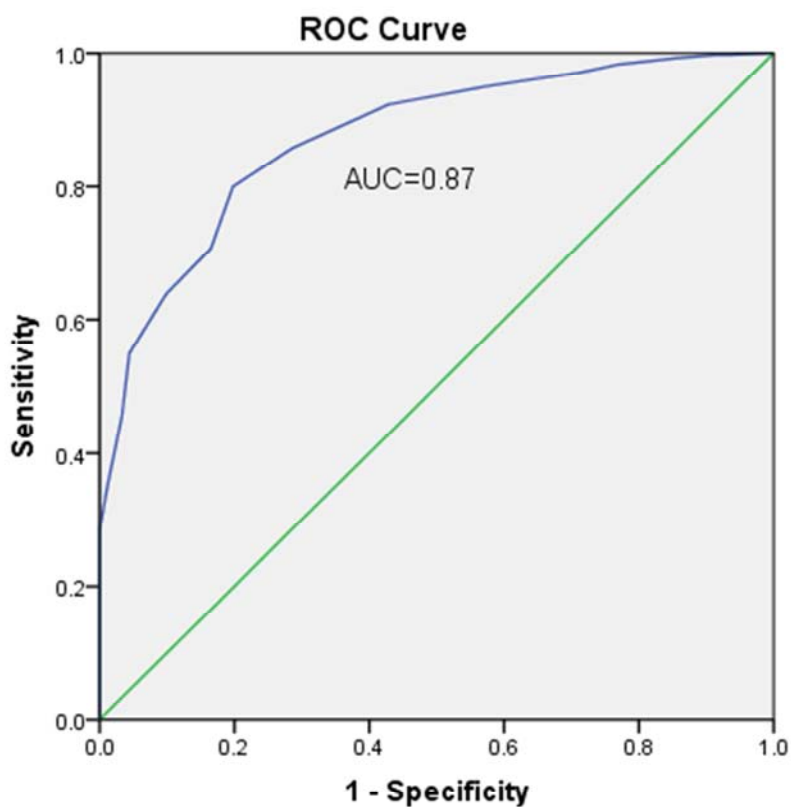


Figure 5: ROC curve of MS-MNA tool in predicting lower BMI (<18.5kg/m²) as a marker of malnutrition in elders of Yeka Sub city, Addis Ababa, Ethiopia, 2017(n=506)

Modified short Mini Nutritional Assessment (MS-MNA) tool showed the highest Cronbaches α value ($\alpha=0.71$) compared to full MNA and MNA-SF. In contrast, high sensitivity and specificity observed in the full MNA tool. Very low reliability was showed in short mini nutritional assessment (MNA-SF) tool (**Table 13**).

Table 13: Comparison in validity and reliability of full MNA, MNA-SF and MS-MNA in Yeka sub city, Addis Ababa, Ethiopia,2017(n=506)

Parameter	MNA	MNA-SF	MS-MNA
Reliability(Cronbaches α)	0.7 [*]	0.5 ⁺	0.71 [*]
Accuracy	0.91 [#]	0.93 [#]	0.87 ^{##}
Sensitivity	87.9 %	85.7%	80%
Specificity	89.6%	89.7%	80.2%

MNA=full Mini Nutritional Assessment, MNA-SF= Short Form Mini Nutritional Assessment, MS-MNA= Modified Short Mini Nutritional Assessment

^{*}Reliability acceptable ⁺ Reliability not acceptable [#]Accuracy in excellent range ^{##} Good accuracy

6. DISCUSSION

Simple and clinically useful instrument for the nutritional screening of older people is very important to prevent, detect and treat under nutrition, to prevent unwanted complications in the geriatric population. Thus the MNA was developed to be easy to use in identifying older people who are nutritionally at risk[32]. The MNA has been used in hundreds of studies in a wide range of different settings and in many countries. Many literature reviews concerning nutritional assessment tools in elderly people, and in particular the MNA, have been published[27]. Guigoz *et al.* in 2006 published a systematic review on observational and interventional studies concerning nutritional assessments of over 30,000 elderly persons[8]. Eventhough the life expectancy of Ethiopian elders is increasing; there was no valid tool to assess the nutritional status of elders. Single anthropometric measurements may not be reliable to assess the nutritional status of elders if used as a single measurement. MNA tool was not validated for Ethiopian elders. Hence, the reliability, validity and over all accuracy of MNA tool evaluate in this study.

In the present study, the reliability of the full MNA tool by Cronbaches alpha was found 0.7 which was acceptable and implied that the full MNA tool is reliable to assess the nutritional status of elders. The reliability actually measures how the items of MNA tool were consistent, homogenous and relatively measures the same parameter[34]. The correlation between the items of the MNA tool were positive, which showed all items are relatively measuring correlated with each other positively. Higher value of Cronbaches Alpha (close to 1) implies better reliability of the tool. BMI had higher correlation to the total MNA score and removing BMI from items in determining reliability results in lower Cronbaches α value. This implies that BMI is the most important item in the tool to assess the nutritional status of elders.

In the reliability of full MNA tool, deleting Pressure sore and more than 3 prescription drug from the full MNA tool increases the value of Cronbaches alpha. Pressure sore or skin ulcer commonly developed in elders when they spent most of their time on bed due to chronically ill or age related[12]. Similarly, elders may took multiple drugs (more than 3 prescription drugs) if they were hospitalized or at home with follow up. Both parameters included to assess the nutritional status of hospitalized patients and clinically ill elders[35]. However, this study conducted among community dwelling elders with low prevalence of pressure sore and multiple

prescription drugs. Despite this fact, many elders included in this study have no skin ulcers (pressure sore) and did not take multiple prescription drugs. As a result, poor correlation of these 2 parameters observed and showed higher Cronbachs alpha if they were omitted from the tool. In Brazil , the study conducted on validation of MNA tool among institutionalized elders revealed consistent result to the present study on inter item correlation between each item of the tool and the total MNA score. The Brazil study showed pressure sore and multiple drug prescription had significant correlation as because the study participants were institutionalized. [14].

The validity of the MNA tool highly depends on the correlation between the MNA tool and the anthropometric measurements which were considered as criterion. In the present study, strong and significant positive correlation observed between the total MNA score and single anthropometric measurements. High correlation between the MNA tool and BMI implies the criterion validity of the tool and shows high interrelatedness of the MNA tool and BMI. This finding suggests that the tool can identify the nutritional status of elderly population. Similarly, significant positive correlation between total MNA score and single anthropometric measurements observed from the study conducted in Iran, Hawassa, Brazil and Nepal [14, 15, 23, 31].

The overall accuracy of MNA tool was assessed using ROC curve and found 0.91 (91%) which falls in excellent category. This finding implies that the proportion of MNA tool to correctly identify malnourished and well-nourished elderly individuals is 91%. This means that only 9% of elders were identified incorrectly as malnourished or well-nourished. The larger the AUC, the better is overall performance of the MNA tool to correctly identify nutritional status of elders. The study conducted in Hawassa found the area under the curve to indicate over all accuracy of MNA tool was 84% which was lower compared to the present study[15]. The area under the curve to estimate the accuracy of the tool observed in the present study was relatively similar from the study observed in Spain, which was 0.88 (88%)[34].

The current study showed the sensitivity and specificity of full MNA 87.9 % and 89.6% respectively. The original developers of MNA reported high sensitivity (96%) and specificity (98%) than the current study[35]. However the current study, sensitivity (87.9%) and specificity

(89.6%) were consistent with the study conducted in Nepal[31]. Eventhough, there was lower specificity observed from the study conducted in Hawassa, the sensitivity observed from the current study was consistent[15]. The current study finding on sensitivity and specificity was nearly similar with the study revealed from Iran which was 82% and 88% respectively[23]. Youden index used to determine the maximum sensitivity and specificity value of MNA tool. Using the best cut of points (MNA score 16 according to Youden index), the sensitivity increased by 2.5 % and specificity lowered by 2.8%. The current study showed high sensitivity and specificity of the MNA tool which indicates the tool can correctly identifies true positives(87.9 % of elders correctly identified as malnourished) and true negatives(89.6 % of elders correctly identified as well-nourished).

In MNA-SF the reliability using Cronbaches α coefficient was found 0.5 which is lower and indicates each items of MNA-SF were not consistent. Cronbaches alpha less than 0.7 was not acceptable. In this study, it is difficult to conclude that MNA-SF is reliable. This finding is much lower from the study conducted in Iran, Cronbaches α coefficients 0.6[23] and from the finding of full MNA reliability in the present study. The overall accuracy of MNA-SF was calculated using ROC curve and the area under the curve (AUC) was found 0.93 which falls in an excellent category. Full MNA and short MNA-SF showed relatively similar accuracy, 0.91 and 0.93 respectively.

Modified Short Mini Nutritional Assessment (MS-MNA) tool revealed acceptable reliability with Cronbaches α value of 0.711 which implied each items of the tool were consistent and homogenous to measure the same parameter. This result was higher value compared to the study revealed in Hawassa and Iran which is 0.65 and 0.6 respectively[15, 23]. MS-MNA score also showed positive correlation to all eight items of MS-MNA tool. For all items, Deleting each items of MS-MNA tool resulted in lower value of Cronbaches α compared to the value obtained from eight items. This implies that all items of the tool were important to assess the nutritional status of elders.

The overall accuracy of MS-MNA was found 87% which is good to assess the nutritional status of elders. This result implies that the proportion of elders correctly identified as well-nourished and malnourished elders were 87%. This finding was similar to the study conducted in Hawassa

with accuracy of 84 % [15] and with the study conducted in Spain which is 88% [27]. Using Youden index the best cut of point was 14.5 with sensitivity and specificity of 80% and 80.2% respectively. This indicates the tool can correctly identifies true positives (80% of elders correctly identified as malnourished) and true negatives (80.2 % of elders correctly identified as well-nourished).

The validity of the MS-MNA tool highly depends on the correlation between the MS-MNA tool and the anthropometric measurements which were considered as criterion. In the present study, significant positive correlation observed between the total MS-MNA score and single anthropometric measurements. High correlation between the MS-MNA tool and BMI implies the criterion validity of the tool and shows high interrelatedness of the MS-MNA tool and BMI. This finding suggests that the tool was valid and can identify the nutritional status of elderly population.

The MS-MNA is noninvasive, short and easy to administer for elders. The MS- MNA can also be easily administered by peripheral or primary level health staff, without the need for biochemical testing or specific training in nutrition. In Ethiopia, primary level health personnel, who have little clinical background, exposed in most of the burden of providing health services. In this case, MS-MNA helps them to easily assess the nutritional status of elders in limited availability of laboratory testing. In addition, MS-MNA is more preferable than full MNA in that, the two items “protein intake and vegetable intakes” were difficult to measure in a full MNA tool and they were not included in MS-MNA tool.

6.1 Strength of the Study

Validity of MNA tool was not done before in Addis Ababa and considered as the strength of the study. The newly derived MNA tool, called MS-MNA was not done before for Ethiopian elderly population and the current study develop the MS-MNA tool from full MNA tool and appetite questionnaire. The study conducted in the community dwelling elder which is generalizable to the community.

6.1 Limitation of the Study

The study has limitations. First, Dietary assessment methods and indicators for micronutrient status were not assessed for participants. Secondly, BMI was used as the standard marker for nutritional status for the purpose of tool validation. BMI has limited applicability in the nutritional assessment of obese individuals who are malnourished and may underestimate malnutrition[31]. However as only 17 of 506 participants in the current study had BMI ≥ 30 , it is unlikely that these findings are underestimated in the current study. There also be selection bias during data collection time in selecting elderly peoples.

6.2 Conclusion

The current study demonstrated that the original full MNA tool was reliable and valid to identify malnourished and risk of malnutrition. However, the MNA-SF was not reliable tool to assess the nutritional status of elders in Yeka sub city, Addis Ababa, Ethiopia. The MS-MNA tool derived from MNA and SNAQ was found reliable and valid nutritional assessment tool and can be used instead of the full MNA tool. MS-MNA was also shorter, small number of items and easier than the full MNA tool.

6.3 Recommendation

For programme managers

MNA tool was valid to assess the nutritional status of elders in Yeka subcity, Addis Ababa. MS-MNA tool was more time saving easy to use and small number of item than full MNA tool. For that reason, using MS-MNA to assess the nutritional status of elders is more advantages than full MNA.

For Health care professionals

The validated full MNA tool was easy and did not need special training to use the MNA tool in health care facility. MS-MNA was short but valid, non-invasive and easy to use to assess elder's nutritional status and can be used instead of full MNA tool. Therefore; greater attention in the assessment of the nutritional status of elders using the tool is needed.

For researchers

A future study validating the MNA, MNA-SF and MS-MNA tool including content validity is required against physician clinical assessment accompanied by laboratory diagnosis of nutritional status to assess micronutrient.

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Appendices

ANNEX I- Consent form (English version)

Study Information sheet, consent form and questionnaires for elderly people
(English version)

Study Information Sheet.

Dear respondent my name is ----- . I am working as a data collector in the study conducted by the school of public health, department of human nutrition, Addis Ababa University. We are interviewing elderly dwellers age greater than 60 in order to generate information necessary for the planning appropriate interventions to promote the nutritional status of elders. To attain this objective, your honest and genuine participation by responding to the question prepared is very important and highly appreciated.

We will proceed to the interview after you understand the following points

Objective- To evaluate the reliability and validity of mini nutritional assessment tool among community dwelling elders in Yeka sub city, Addis Ababa, Ethiopia.

Benefit – the study may have no direct benefit for the participants. But the information generated from the help policy makers and health care professionals for designing appropriate intervention.

Harm – the participants do not have any harm by participating to the study

Duration of the study –the study conducted for one month. Participants are interviewed and required anthropometric measurements are taken at the time of interview.

Duration of the interview- the interview may take 20- 30 minutes

Alternatives to participation- you do not have to take part in this research if you do not wish to do so and refusing to participate will not have any harm for you and your family. If you have question unclear you have a right to ask clarification. If you have also a question that you don't want to answer you can skip it .you will still have all the benefits that you would otherwise have at this center. You may stop participating in the research at any time.

Confidentiality: I am going to ask some questions that you may find it difficult to answer. Your answers are completely confidential. Your name will not be written in this form and will never be used in connection with any information you tell us. All information given by you will be kept confidential.

Are you willing to participate in this study? 1. Yes 2. No

Consent for elders (English Version)

I have read this form or it has been read to me in the language that I understand. I understand all conditions stated above. Therefore, I am willing to participate in this study.

Signature-----

Name of principal investigator:

Mesfin Agachew

Address: tell: +251918199097

Email – mesfinagachew@gmail.com, agachewmesfin@yahoo.com

Signature-----

Name of interviewer-----

Signature-----

Name and sign of supervisor-----

ANNEX II- Questionnaire (English Version)

Date of interview	_ _ Day _ _ Month _ _ _ _ Year
Time started	Hour _ _ Minutes _ _
Time ended	Hour _ _ Minutes _ _
Result*	_
Interviewer Name	-----
Supervisor	-----
Checked by	-----
*Result codes	1=Completed 2=Not 3=Postponed 4=Refuse 5=Partly Completed 6=Incapacitated 7=Other (Specify)

PART ONE

Anthropometric measurements (should be taken twice)

s.no		
100	Weight	1st-----kg 2nd-----kg Average-----kg not recorded-----9998
101	Height	1st.....centimeter 2nd-----centimeter not recorded -----998 Average-----centimeter
102	Mid arm circumference	1st.....centimeter 2nd-----centimeter not recorded-----98 Average-----centimeter
103	Calf circumference	1st.....centimeter 2nd-----centimeter not recorded-----98 Average-----centimeter

PART TWO

Questions pertaining to socio demographic and economic characteristics of respondents

s.no	Question and filters	Coding categories	Skip question
104	Sex	Male.....1 Female.....2	
105	In what month and year you were born?	Month----- don't know--99 Year -----don't know---9999	
106	How old are you(complete in years)	-----	
107	What is Your Religion?	Orthodox.....1 Muslim.....2 Protestant.....3 Other(Specify).....8	
108	What is your ethnicity?	Oromo.....1 Amhara.....2 Tigre.....3 Gurage.....4 Other Specify.....8	
109	What is Your Educational Status?	Unable to read and write-----1 Read and write-----2 Primary education (1-8)-----3 Secondary and above(>9)-----4	
110	What is your marital status?	Married-----1 Widowed-----2 Single/divorced/separated-----3	
111	What is Your Educational Status of your partner?	Unable to read and write-----1 Read and write-----2 Primary education (1-8)-----3 Secondary and above(>9)-----4	
112	Type of primary care giver?	Partner-----1 Child-----2 Relatives-----3 living alone -----4 other (specify-----8	
113	What is the occupation of care taker	Government employ-----1 Farmer-----2 Merchant-----3 Other(specify-----8	
114	How many people are living in your Home?	-----	
115	With whom you are living at home?	Partner-----1	

		Children-----2 Alone-----3	
116	What is your monthly income	-----birr	
117	Does your household have:	Yes No	
	Electricity?	Electricity? 1 2	
	Radio?	Radio? 1 2	
	Television?	Television? 1 2	
	Telephone?	Telephone? 1 2	
	Personal computer?	Personal computer? 1 2	
	Internet?	Internet? 1 2	
	Refrigerator?	Refrigerator? 1 2	
	A table?	A table? 1 2	
	A chair?	A chair? 1 2	
118	Does anyone of your household member own:	Yes No	
		A bajaji/motorcycle? 1 2	
		An animal-drawn cart? 1 2	
		A car/truck? 1 2	
		A bicycle? 1 2	
119	How many rooms in this household are used for sleeping?	ROOMS _____	
120	Main material of the floor(observe) [Finished-polished wood, asphalt, ceramic, cement & carpet]	Natural (earth/sand)-----1 Rudimentary (wood/bamboo)---2 Finished floor-----3 Other (specify)-----9	
121	Main material of the roof (observe) [Finished roofing-corrugated iron/metal, wood, cement, concrete]	Natural roofing (no roof/leaf)----1 Rudimentary-----2 (plastic/bamboo/wood)-----3 Finished roofing-----4 Other (specify)-----9	
122	Main material of the exterior wall (observe) [Natural wall- if no wall, or cane/trunks/bamboo/reed or dirt]	Natural wall (no wall/reeds/dirt)-1 Rudimentary wall-----2 Finished wall-----3 Other (specify)-----9	
123	What is the main source of drinking water for your household?	Tap water (piped into house or yard) -----1 Protected dug well/spring /rain water-----2 Public tap-----3 Other (specify) _____ 9	
124	What kind of toilet facility does members of your household use?	Pour flush latrine (private or shared)----- 1 Pit latrine (private or shared)----2 Public toilet-----3 Other (specify)_____ 9	

125	Does any member of this household have a bank or microfinance saving account?	Yes-----1 No -----2	
-----	---	------------------------	--

PART THREE

Mini Nutritional Assessment (MNA) tool to assess the nutritional status of elders
Complete the screen by filling in the boxes with the appropriate numbers.

s.no	Assessment tool	Category and corresponding score	score
126	Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or Swallowing difficulties?	0 = severe decrease in food intake 1 = moderate decrease in food intake 2 = no decrease in food intake	
127	Weight loss during the last 3 months	0 = weight loss greater than 3kg (6.6lbs) 1 = does not know 2 = weight loss between 1 and 3kg 3 = no weight loss	
128	Mobility	0 = bed or chair bound 1 = able to get out of bed / chair but does not go out 2 = goes out	
129	Has suffered psychological stress or acute disease in the Past 3 months?	0= Yes 2= No	
130	Neuropsychological problems	0 = severe dementia or depression 1 = mild dementia 2 = no psychological problems	
131	Body Mass Index (BMI)= weight in kg/ (height in m ²)	0 = BMI less than 19 1 = BMI 19 to less than 21 2 = BMI 21 to less than 23 3 = BMI 23 or greater	
	Subtotal screening score for MNA short form		
132	Lives independently (not in nursing home or hospital)	1 = yes 0 = no	
133	Takes more than 3 prescription drugs per day	0 = yes 1 = no	
134	Pressure sores or skin ulcers	0 = yes 1 = no	
135	How many full meals does the patient eat daily?	0 = 1 meal 1 = 2 meals 2 = 3 meals	
136	Selected consumption markers		

	<p>for protein intake</p> <ul style="list-style-type: none"> • At least one serving of dairy products(milk, cheese, yoghurt) perday ----yes/no • Two or more servings of legumesor eggs per week --- yes/no • Meat, fish or poultry every day--- yes/no 	<p>0.0 = if 0 or 1 yes 0.5 = if 2 yes 1.0 = if 3 yes</p>		
137	Consumes two or more servings of fruit or vegetables per day?	<p>0= no 1=yes</p>		
138	How much fluid (water, juice, coffee, tea, milk...) is Consumed per day?	<p>0.0 = less than 3 cups 0.5 = 3 to 5 cups 1.0 = more than 5 cups</p>		
139	Mode of feeding	<p>0 = unable to eat without assistance 1 = self-fed with some difficulty 2 = self-fed without any problem</p>		
140	Self-view of nutritional status	<p>0 = views self as being malnourished 1 = is uncertain of nutritional state 2 = views self as having no nutritional problem</p>		
141	In comparison with other people of the same age, how does the patient consider his / her health status?	<p>0.0 = not as good 0.5 = does not know 1.0 = as good 2.0 = better</p>		
142	Mid-arm circumference (MAC) in cm	<p>0.0 = MAC less than 21 0.5 =MAC 21 to 22 1.0 = MAC greater than 22</p>		
143	Calf circumference (CC) in cm	<p>0 = CC less than 31 1 = CC 31 or greater</p>		
	<i>total screening score</i>			
	<p>total assessment (max. 30 points) malnutrition indicator score ≥ 24 points well-nourished-----1 17 to 23.5 points at risk of malnutrition-----2 < 17 points malnourished-----3</p>			

Simplified Nutritional Appetite Questionnaire (SNAQ)

s.no	question	Coding and category	score	
144	My appetite is	Very poor -----1 Poor-----2 Average-----3 Good-----4 Very good-----5		
145	When I eat	I feel full after eating only a few mouthfuls -----1 I feel full After eating about a third of my meal -----2 I feel full After eating over half of a meal-----3 feel full After eating most of the meal-----4 I hardly ever feel full-----5		
146	Food tastes	Very bad-----1 Bad-----2 Average-----3 Good-----4 Very good-----5		
147	Normally I eat	Less than one meal a day-----1 one meal a day-----2 two meals a day-----3 three meals a day-----4 more than three meals a day-----5		
		Total score		
	Score <= 14 risk for 5% wt loss within 6 month-----1 Score>14 no risk-----2			

ANNEX III- Consent form (Amharic version)



አዲስ አበባ ዩኒቨርሲቲ የህብረተሰብ ጤና ት/ቤት

የጥናቱ አጠቃላይ መረጃ፡ የፈቃደኝነት መጠየቂያ እና ቃለ መጠይቅ (የአማርኛ ትርጉም)

ምእራፍ አንድ፡- የጥናቱ አጠቃላይ መረጃ

ጤና ይስጥልን ስሜ ----- ይባላል። እኔ በአዲስ አበባ ዩኒቨርሲቲ የህብረተሰብ ጤና ት/ቤት ስርአተ ምግብ ትምህርት ክፍል በሚካሄደው ጥናት መረጃ እየሰበሰብኩ ነዉ። የአረጋግጥን አመጋገብ በተመለከተ እድሜያቸው ከ 60 ዓመት በላይ ለሆኑ አረጋግጥን ቃለ መጠይቅ እያደረግን ነዉ ይህ መረጃም ዉጤታማ እርምጃዎችን ለመወሰድና የተሻለ የአመጋገብ ስርዓት እንዲኖራቸው ለማድረግ ያስችላል። ይህን ለማሳካት የእርስዎ ተሳትፎ በጣም ትልቅ አስተዋጽኦ አለዉ። ለምንጠይቀዎት ጥያቄ እዉነተኛ ምላሽ ስለሰጡን ከፍተኛ አድናቆትና ምስጋና ከወድሁ እናቀርባለን።

የሚከተሉትን ነጥቦች በተገቢዉ መንገድ ከተረዱ በኋላ ወደ መጠይቁ እንሄዳለን

የጥናቱ ዓላማ - የዚህ ጥናት ዋና ዓላማ በአዲስ አበባ በየካ ክፍለ ከተማ የሚኖሩ አረጋግጥን ለይ የአመጋገብ ሁኔታ ማጥናትና የአመጋገብ ሁኔታን ሊለካ የሚችን መለኪያ መስፈርት ትክክለኛነቱን ማረጋገጥ ነዉ።

የሚገኝ ጥቅም - ለጥናቱ ተሳታፊዎች ቀጥተኛ የሆነ ጥቅም ላይኖር ይችላል። ነገር ግን የሚገኘዉን መረጃ የፖሊሲ አዉጭዎች፣ የጤና ባለሙያዎችና ሌሎችም መረጃዉን ለአረጋጋዉን ከአመጋገብ ጋር ተያይዞ ላሉ ችግሮች እንደ መፍትሄ ይጠቀሙበታል።

የሚደርስ ጉዳት - ለዚህ ቃለ መጠይቅ የተሳተፉ ደንበኞች ስለተሳተፉ የሚደርስ ምንም ዓይነት ጉዳት የለም

ጥናቱ የሚወስደዉ ጊዜ - ጥናቱ የሚካሄደዉ ለ አንድ ወር ነዉ. ቃለ መጠይቅ በሚደረግበት ወቅት የተሳታፊዎች ቁመትና ከብደት ይወሰዳል።

ቃለ መጠይቁ የሚወስደዉ ጊዜ- ቃለ መጠይቁ ከ 20 እስከ 30 ደደቂቃ ሊወስድ ይችላል።

ያለመሳተፍ መብት- በዚህ ቃለ መጠይቅ ፈቃደኛ ካልሆኑ ያለበሳተፍ መብት አለዎት። በዚህም ምክንያት በእርስዎም ላይ ሆነ በቤተሰብ ላይ የሚደርሰስ ምንም ዓይነት ችግር የለም።በቃለ መጠይቅ ወቅት ለእርስዎ ግልጽ ያልሆነ ነገር ካለ መጠየቅ ይችላሉ። ለመመለስ ፈቃደኛ ያልሆኑበት ጥያቄ ካለም ማለፍ ይችላሉ። በየትኛዉም ምክንያት በመጠይቁ መሃል መቋረጥ ቢፈልጉ ጥያቄዉን የማቋረጥ መብት አለዎት

ሚስጥር መጠበቅ: በመጠይቁ ላይ ብዙ ጥያቄዎችን ሊመልሱ ይችላሉ። ነገር ግን ለሚሰጡት መልስ ሚስጥራዊነት የተጠበቀ ነው። የእርስዎ ስም በዚህ ፎርም ላይ አይጻፍም ። ከዚህም ሌላ ከመረጃው ወጭ የእርስዎ ማንነት ከጥናቱ ጋር ምንም ዓይነት ግንኙነት አይኖረውም። ስለዚህ እርስዎ የሚሰጡን መረጃ ሙሉ በሙሉ ሚስጥራዊነቱ የተጠበቀ

ለዚህ ጥናት እርስዎ ፈቃደኛ ነዎት ? 1. አዎ 2. ፈቃደኛ አይደለሁም

ምእራፍ ሁለት የፈቃደኝነት መጠየቂያ ቅጽ

እኔ በሚገባኝ ቋንቋ ሃሳቡ ተነባብሮኛል ወይም አንብቤዋለሁ. በዚህም መሰረት የጥናቱን ሃሳብና ዓላማ በሚገባ ተረድቻለሁ። ስለዚህ በዚህ ቃለ መጠይቅ ለመሳተፍ ፈቃደኛ ነኝ።

ፊርማ -----

የተመራማሪው ስም: መስፍን አጋጨዉ

አድራሻ: ስልክ ቁጥር - +251918199097

Email – mesfinagachew@gmail.com, agachewmesfin@yahoo.com

ፊርማ -----

የጠያቂው ስም -----

ፊርማ-----

የሱፐርቫይዘር ስም እና ፊርማ-----

ቃለ መጠይቅ የተደረገበት ቀን	ቀን ወር
የተጀመረበት ሰዓት	ሰአት ደቂቃ
ያለቀበት ሰአት	ቀን ደቂቃ
* ወ.ጤት	
ቃለ መጠይቅ ያደረገው ስም	-----
የሱፐርቫይዘር ስም	-----
ያረጋገጠው	-----
* የወ.ጤት ኮድ	1=የተጠናቀቀ 2= አላለቀም 3= ለሌላ ቀን ተላልፏል 4= ፈቃደኛ አይደለም 5= በግማሽ አልቋል 6= ሌላካለ ይገለጽ--- -----

ANNEX V- Questionnaire (Amharic version)

ቃለ መጠይቅ

ክፍል አንድ:- የሰውነት ልኬታዎች (እባኩትን ሁለት ጊዜ ይለኩ)

ተ.ቁ		
100	ክብደት	የመጀመሪያ-----ኪ.ግ ሁለተኛ-----ኪ.ግ አማካይ-----ኪ.ግ
101	ቁመት	የመጀመሪያ.....ሴ.ሜ ሁለተኛ-----ሴ.ሜ አማካይ-----ሴ.ሜ
102	የመሃል ከንድ ልኬታ	የመጀመሪያ.....ሴ.ሜ ሁለተኛ-----ሴ.ሜ አማካይ-----ሴ.ሜ
103	የባት ልኬታ	የመጀመሪያ.....ሴ.ሜ ሁለተኛ-----ሴ.ሜ አማካይ-----ሴ.ሜ

ክፍል ሁለት:- የማህበራዊና ሥነ- ባህሪያት መገለጫ መጠይቅ

ተ.ቁ	ጥያቄ	ከድ	ጥያቄውን ይለፉ
104	ጾታ	ወንድ.....1 ሴት.....2	
105	የትውልድ ዘመን ይነግሩኛል?	ወር----- አላወቅም-----99 አመት -----አላወቅም-----99	
106	እድሜዎ ስንት ነው?	-----	
107	የእርስዎ ሄማኖት ምንድን ነው?	አርቶዶክስ.....-1 ሙስሊም.....2 ፕሮቴስታንት.....3 ሌላ.....999	
108	የእርስዎ ብሄር ምንድን ነው?	አሮሞ.....1 አማራ.....-2 ትግሬ.....3 ጉራጌ.....-4 ሌላ ካለ ይግለጹ.....999	
109	የትምህርት ደረጃ?	መጻፍ እና ማንበብ አልቻልኩም-----1 መጻፍ እና ማንበብ አቻላለሁ-----2 የመጀመሪያ ደረጃ ት/ት አጠናቅቄለሁ (1-8)-----3 ሁለተኛ ደረጃ እና ከዚያ በላይ (>9)-----4	
110	የጋብቻ ሁኔታ	ያገባ -----1 የሞተበት-----2 የፈታ/ያላገባ-----3	
111	የትምህርት ደረጃ	መጻፍ እና ማንበብ አልቻልኩም-----1 መጻፍ እና ማንበብ አቻላለሁ-----2	

		የመጀመሪያ ደረጃ ትምህርት አጠናቅቆለሁ (1-8)----3 ሁለተኛ ደረጃ እና ከዚያ በላይ (>9)-----4																															
112	እርስዎን በቅርብ የሚንከባከቡት ማነዉ?	የትዳር ጓደኛዎ.....1 ልጆች.....2 ዘመድ.....3 ብቻዎን ነኝ-----4 ሌላ ይገለጹ-----999																															
113	የሚንከባከቡት ሰው ስራዉ ምንድን ነዉ?	የመንግስት ሰራተኛ -----1 ገበሬ-----2 ነጋዴ-----3 ሌላ ካለ ---999																															
114	ቤት ዉስጥ ስንት ሰዉ ይኖራል ?	-----																															
115	ቤት ዉስጥ የሚኖሩት ከማን ጋር ነዉ?	ትዳር ጓደኛ-----1 ልጆች-----2 ለብቻዎ-----3																															
116	እርስዎ የ ወር ገቢ ምን ያክል ነዉ?	-----ብር																															
117	በቤት ዉስጥ የሚከተሉት አሉ ማለፍ ከምጥገዉ ተርፍ?	<table border="0"> <tr> <td></td> <td>አዎ</td> <td>የለም</td> </tr> <tr> <td>ሙብራት?</td> <td>1</td> <td>2</td> </tr> <tr> <td>ራዲዮ?</td> <td>1</td> <td>2</td> </tr> <tr> <td>ቴሌቪዥን?</td> <td>1</td> <td>2</td> </tr> <tr> <td>ስልክ?</td> <td>1</td> <td>2</td> </tr> <tr> <td>የግል ኮምፒዉተር?</td> <td>1</td> <td>2</td> </tr> <tr> <td>የመረጃ መረብ ?</td> <td>1</td> <td>2</td> </tr> <tr> <td>ፍሪጅ?</td> <td>1</td> <td>2</td> </tr> <tr> <td>ጠረንጌዛ?</td> <td>1</td> <td>2</td> </tr> <tr> <td>ወንበር?</td> <td>1</td> <td>2</td> </tr> </table>		አዎ	የለም	ሙብራት?	1	2	ራዲዮ?	1	2	ቴሌቪዥን?	1	2	ስልክ?	1	2	የግል ኮምፒዉተር?	1	2	የመረጃ መረብ ?	1	2	ፍሪጅ?	1	2	ጠረንጌዛ?	1	2	ወንበር?	1	2	
	አዎ	የለም																															
ሙብራት?	1	2																															
ራዲዮ?	1	2																															
ቴሌቪዥን?	1	2																															
ስልክ?	1	2																															
የግል ኮምፒዉተር?	1	2																															
የመረጃ መረብ ?	1	2																															
ፍሪጅ?	1	2																															
ጠረንጌዛ?	1	2																															
ወንበር?	1	2																															
118	በቤት ዉስጥ አባል አንዱ የሚከተሉት አሉት?	<table border="0"> <tr> <td></td> <td>Yes</td> <td>No</td> </tr> <tr> <td>ባጃጅ/ሞተር</td> <td>1</td> <td>2</td> </tr> <tr> <td>ጋር</td> <td>1</td> <td>2</td> </tr> <tr> <td>መኪና</td> <td>1</td> <td>2</td> </tr> <tr> <td>ብስክሌት</td> <td>1</td> <td>2</td> </tr> </table>		Yes	No	ባጃጅ/ሞተር	1	2	ጋር	1	2	መኪና	1	2	ብስክሌት	1	2																
	Yes	No																															
ባጃጅ/ሞተር	1	2																															
ጋር	1	2																															
መኪና	1	2																															
ብስክሌት	1	2																															
119	በዚህ ቤት ዉስጥ ለመንገድ ስንት ክፍሎችን ትጠቀማላችሁ?	----- ክፍል																															
120	የቤቱ ወለል የተሰራዉ ከምንድን ነዉ(ይመልከቱ)	መሬት-----1 ጣዉላ -----2 ያለቀ ወለል-----3 ሌላ (ይገለጹ)-----999																															
121	የቤቱ ጣሪያ የተሰራዉ ከምንድን ነዉ(ይመልከቱ)	ጣራ የለዉም-----1 ያለቀ/መጠነኛ-----2 (ፕላስቲክ/ሽምብቆ/እንጨት)-----3 በደንብ ያለቀ ጣሪያ-----4 ሌላ (ይገለጹ)-----999																															
122	የቤቱ የዉጭ ግድግዳ የተሰራዉ ከምንድን ነዉ(ይመልከቱ)	ግድግዳ የለዉም-----1 ያለቀ/ መጠነኛ-----2 ያለቀለት ግድግዳ-----3 ሌላ(ይገለጹ)-----999																															
123	በቤት ዉስጥ የዉሃ ምንጫችዉ/የምታገኙት ከየት ነዉ?	ቧንቧ ዉሃ -----1 የምንጭ/የዝናብ ዉሃ-----2 የህዝብ ቧንቧ ዉሃ-----3																															

		ሌላ (ይገለጽ) _____-999	
124	የቤቱ አባላት የሚጠቀሙት መጻዳጃ ቤት ምን ዓይነት ነው?	ወሃ መልቀቂያ ያለው (የግል/ ጋራ)-----1 የጉድጓድ ሽንት ቤት(የግል/ ጋራ)-----2 የህዝብ ሽንት ቤት-----3 ሌላ (ይገለጽ) _____-999	
125	በቤት ውስጥ የባንክ አካውንት ለው ሰው አለ?	አዎ-----1 የለም -----2	

ክፍል ሶስት:-የአረጋቂያንን የአመጋገብ ሁኔታ የሚዳስስ መጠይቅ

ተ.ቁ	መለኪያ	የወጤት ክፍፍልና ኮድ	ወጤት
126	ላለፉት 3 ወራት በምግብ ፍላጎት መቀነስ ወይም በሌላ ምክንያት የሚወስዱት የምግብ መጠን ቀንሶታል?	ከፍተኛ የምግብ ፍላጎት መቀነስ = 0 ነጥብ-----1 መካከለኛ የምግብ ፍላጎት መቀነስ = 1 ነጥብ-----2 ምንምምግብ ፍላጎት መቀነስ አይታይም = 2 ነጥብ -----3	
127	ባለፉት 3 ወራት የነበረ ክብደት መቀነስ ነበር	ከ 3 ኪሎ በላይ የቀነሰ = 0 ነጥብ -----1 አላወቀውም = 1 ነጥብ-----2 የክብደት መቀነስ ከ 1-3 ኪሎ = 2 ነጥብ-----3 ምንም የክብደት መቀነስ የለም = 3 ነጥብ-----4	
128	የእንቅስቃሴ ሁኔታ ምን ይመስላል?	የአልጋ ቁራኛ = 0 ነጥብ-----1 ከአልጋ መነሳት እችላለሁ ግን ወደ ወጭ መውጣት አልችልም- = 1 ነጥብ -----2 ወደ ወጭ መውጣት እችላለሁ = 2 ነጥብ-----3	
129	ለለፉት 3 ወራት ስነ- ልቦና ጭንቀት ወይም ህመም ገጥሞዎት ያወቃል?	አዎ = 0 ነጥብ-----1 አይ አያወቅም = 1 ነጥብ-----2	
130	የአእምሮ እና የስነ- ልቦና ችግሮች አሉ?	ከፍተኛ የሆነ ድብርት = 0 ነጥብ-----1 መካከለኛ የሆነ አእምሮ መሳት = 1 ነጥብ-----2 ምንም የአእምሮ ችግር የለም = 2 ነጥብ-----3	
131	ክብደት ለቁመት በካሬሜትር	BMI < 19 = 0 ነጥብ-----1 BMI 19 to < 21 = 1 ነጥብ-----2 BMI 21 to < 23 = 2 ነጥብ-----3 BMI ≥ 23 = 3 ነጥብ-----4	
132	ያለምንም እገዛ እራስዎን ችለው እየኖሩ ነው?	አይደለም = 0 ነጥብ-----1 አዎ = 1 ነጥብ-----2	
133	በቀን ከ 3 በላይ የታዘዘ መድሃኒት ይወስዳሉ?	አዎ = 0 ነጥብ-----1 አልወስድም = 1 ነጥብ-----2	
134	የቆዳ ላይ ቁስል አለ?	አዎ = 0 ነጥብ-----1 የለም = 1 ነጥብ-----2	
135	በቀን የተሟላ ምግብ ስንት ጊዜ ይመገባሉ?	1 ጊዜ በቀን = 0 ነጥብ-----1 2 ጊዜ በቀን = 1 ነጥብ-----2 3 ጊዜ በቀን = 2 ነጥብ-----3	
136	ለመለኪያነት የተመረጡ የገንቢ ምግቦች * በቀን አንድ ጊዜ የወተት ተዋጽኦ ይመገባሉ? አዎ/አልመገብም	0 ወይም 1 አዎ ከሆነ = 0.0 ነጥብ-----1 2 አዎ ከሆነ = 0.5 ነጥብ-----2	

	* በቀን 2 እና ከዚያ በላይ እንቁላል ወይም ጥራጥሬ ይመገባሉ?አዎ/አይ * ስጋ፣ አሳ በየቀኑ ይመገባሉ?አዎ/አይ	3 አዎ ከሆነ = 1.0 ነጥብ-----3		
137	በቀን 2 እና ከዚያ በላይ አትክልትና ፍራፍሬ ይመገባሉ?	አልመገብም = 0 ነጥብ-----1 አዎ እመገባለሁ = 1 ነጥብ-----2		
138	በቀን ምን ያክል ፈሳሽ(ውሃ፣ ወተት፣ ጁስ)ይወስዳሉ?	ከ 3-ብርጭቆ ያነሰ = 0.0 ነጥብ-----1 ከ3-5 ብርጭቆ = 0.5 ነጥብ-----2 ከ5 ብርጭቆ በላይ = 1.0 ነጥብ-----3		
139	የአመጋገብ ሁኔታ ?	ያለ እገዛ መመገብ አልቻልም = 0 ነጥብ-----1 ትንሽ ብቸገርም በራሴ እመገባለሁ = 1 ነጥብ-----2 ያለ ምንም ችግር እመገባለሁ = 2 ነጥብ-----3		
140	የእርስዎን የአመጋገብ ሁኔታ እንዴት ያዩታል?	በጣም በምግብ የተጎዱ = 0 ነጥብ-----1 አላወቅም / መካከለኛ በምግብ የተጎዱ = 1 ነጥብ-----2 ምንም የምግብ ጉዳት የለም = 2 ነጥብ-----3		
141	እራስዎን በእድሜ እኩል ከሆኑ ሌሎች ሰዎች ጋር ሲያነጻጽሩ የጤናዎ ሁኔታ ምን ይመስላል?	ጥሩ አይደለም = 0.0 ነጥብ-----1 አላወቅም = 0.5 ነጥብ-----2 ጥሩ ነዉ = 1.0 ነጥብ-----3 በጣም ጥሩ ነዉ = 2.0 ነጥብ-----4		
142	የመሃል ከንድ ዙሪያ ልኬታ በሴ.ሜ	MAC < 21 = 0.0 ነጥብ-----1 MAC 21 ≤ 22 = 0.5 ነጥብ-----2 MAC > 22 = 1.0 ነጥብ-----3		
143	የባት ዙሪያ ልኬታ	CC < 31 = 0 ነጥብ-----1 CC ≥ 31 = 1 ነጥብ-----2		
አጠቃላይ ዉጤት				
	(ከፍተኛ . 30 ነጥብ) የምግብ እጥረት አመለካኝ ዉጤቶች ≥ 24ነጥብ = ጥሩ አመጋገብ ያለዉ -----1 17 to 23=ነጥብ5 ለምግብ እጥረት የተቃረበ/የተጋለጠ -----2 < 17ነጥብ =የምግብ እጥረት ያለበት-----3			

የምግብ ፍላጎት ለመዳሰስ የተዘጋጀ መጠይቅ

ተ. ቁ	ጥያቄ	ክፍፍል እና ኮድ	ወጤት	
144	የእርስዎ የምግብ ፍላጎት ምን ይመስላል	በጣም ዝቅተኛ-----1 ዝቅተኛ-----2 መካከለኛ-----3 ጥሩ-----4 በጣም ጥሩ-----5		
145	ምግብ በሚመጡት ወቅት?	ትንሽ ጉርሻ ከጎረሰኩ በኋላ እጠግባለሁ -----1 የምግቡን አንድ ሶስተኛ እንደበላሁ እጠግባለሁ -----2 የቀረበውን ምግብ ግማሽ እንደበላሁ እጠግባለሁ-----3 ከቀረበው ምግብ አብዛኛውን እንደበላሁ እጠግባለሁ-----4 I hardly ever feel full-----5		
146	የምግቡ ጣእም ምን ይመስላል?	በጣም መጥፎ-----1 መጥፎ-----2 መካከለኛ-----3 ጥሩ-----4 በጣም ጥሩ-----5		
147	በመደበኛው በቀን ውስጥ ስንት ጊዜ ይመገባሉ(ጥያቄ ቁ. 139 ይመልከቱ	በቀን ከ አንድ በታች-----1 በቀን አንድ ምግብ-----2 በቀን ሁለት ምግብ-----3 በቀን ሶስት ምግብ-----4 በቀን ከ ሶስት ምግብ በላይ-----5		
		አጠቃላይ ወጤት		
	አጠቃላይ ወጤት <= 14 በሚቀጥሉት 6 ወራት 5 ክብደት የመቀነስ እድል ይኖራል-----1			
	አጠቃላይ ወጤት >14 ክብደት የመቀነስ ስጋት አይኖርም -----2			

